Climate change and heat waves in Paris metropolitan area

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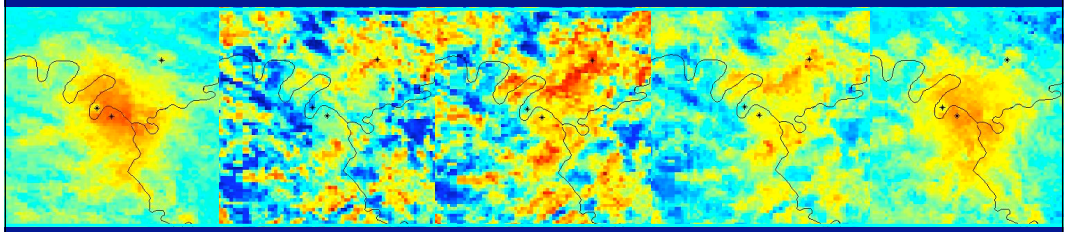


AGU Press-Conference San Francisco, December 13, 2010

Satellite monitoring of the 2003 heat wave in Paris

Climate models predict for the end of the 21 century an increase in frequency, intensity and duration of heat waves.

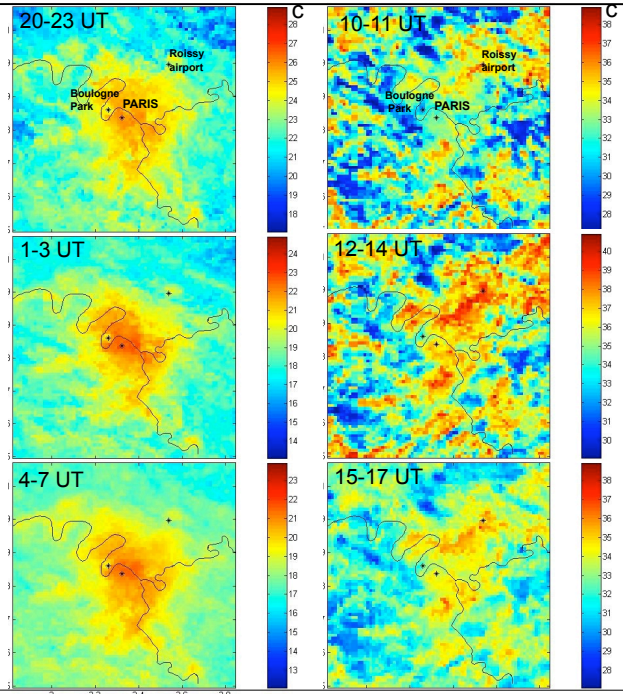
Satellite imaging was used to monitor the surface temperature of Paris during the 2003 heat wave, that resulted in a 4867 excess deaths.

Image time series reveals:

- contrasted patterns of daytime and nighttime urban heat islands, and their relationship to land use;
- that exposure to high temperature during several nights can double the risk of death for the most vulnerable people;
- that a 1% increase of vegetation index decreases by 0.2°C the surface temperature of Paris, in summer afternoons.

Surface temperature variability in Paris, August 2003

night



day

The diurnal cycle of surface temperature reveals contrasted day time / nighttime heat islands

Sequence built from 50 thermal images over 9 days

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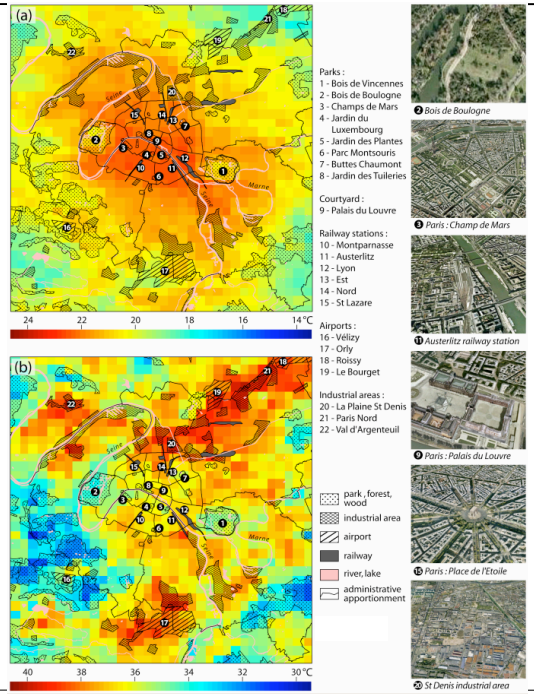
Heat islands and land use in Paris, August 2003



average nighttime image

Heat island of 8ºC (15ºF) centered in Paris

Highest temperatures and mortality occured south of the river

average afternoon image

Heat islands > 10ºC (18ºF) in industrial suburbs

Cooling effect of vegetation in residential suburbs

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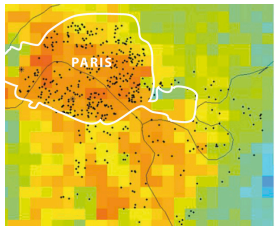
Health impact of the 2003 heat wave in Paris

Exposure to high temperature during several nights can double the risk of death for the most vulnerable people



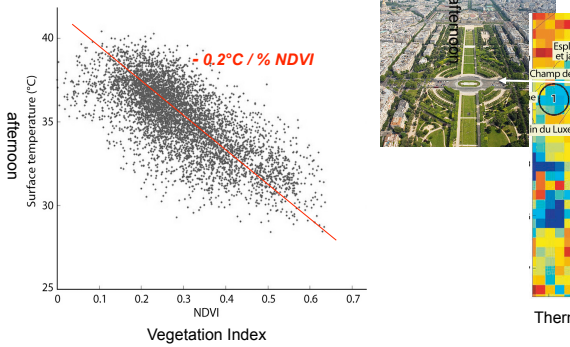
- Heat exposure was computed over 61 thermal images at the addresses of 482 elderly people

Land surface temperature indicators from 61 satellite thermal images	**Odds ratio**
Mean of the minimal temperatures for 7 days	2.22
Mean of the maximal temperatures for 7 days	0.96
Mean of the minimal temperatures: 1-13 August	2.57
Mean of the maximal temperatures: 1-13 August	1.14
Mean of the average temperatures: 1-13 August	2.07

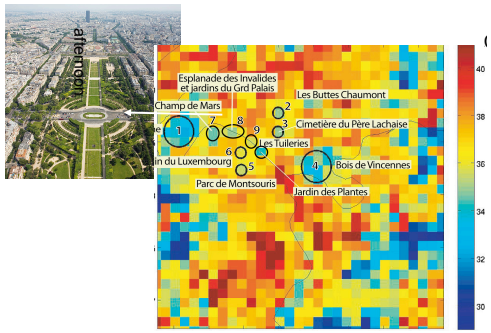
Mitigating effect of urban vegetation in Paris

A 1% increase of vegetation decreases by 0.2°C the surface temperature of Paris, in summer afternoons

August afternoons in Paris: small and large parks were respectively 2°C - 3°C and 4°- 5°C cooler than their built environment



Vegetation Index



Thermal image August 9. 2003, 13:28 UT

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